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Factsheet

NUTRIENT DEFICIENCY SYMPTOMS IN FRUIT CROPS

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(Revision of Fact Sheet "Nutrient Deficiency Symptoms in Fruit Crops", May 1983)

Fourteen nutrient elements obtained from the soil are essential for growth and production of fruit crops, in addition to carbon, oxygen and hydrogen from the air and water. These are classed as macronutrients (N, P, K, Ca, Mg, S), and micronutrients (Fe, Mn, Zn, Cu, B, Mo, Cl, Na) which are required in smaller amounts.

There are three criteria for the essentiality of nutrients: (1) the element is necessary for the plant to complete its life cycle; (2) it must be directly required to the nutrition of the plant; and (3) no other element can completely substitute for it.

Nutrients function either as a part of a compound which is essential for plant growth or as catalysts for specific reactions in the biochemistry of the plant. Magnesium, for example, is a part of chlorophyll molecules. If the plant receives insufficient magnesium, a lack of chlorophyll will develop and leaves appear chlorotic (yellow). Since magnesium is mobile within the plant it will move from the older leaves to young expanding leaves. Symptoms will develop then on the older leaves first. The pattern for nutrient deficiency symptoms is similar in different species or crops, since those symptoms are related to the function and characteristics of the nutrient and are not specific to species. If symptoms are recognized, steps can be taken to correct deficiencies before they become more serious. Deficiency symptoms must be used with caution, however, to determine fertilizer needs. Symptoms can occur late in the season after plant growth or the crop has already been affected. The cause of the deficiency is not indicated by the symptoms. It may be a lack of the nutrient in the soil, excessive levels of other nutrients, high or low soil pH, a lack of moisture or restricted root development causing the symptoms. One should use soil or tissue analysis to confirm what is indicated by deficiency symptoms. Excessive levels also cause problems in fruit production and growers should be aware of symptoms of excess.

Nitrogen deficiency in fruit crops results in yellow-green, undersized leaves and reduced growth. The bark of shoots and twigs may become reddish in color and shoot growth is spindly. If deficiency is prolonged, older leaves become orange to reddish in color and may drop prematurely.

Fruit bud formation and fruit set may be restricted if nitrogen is deficient. Fruit is small and highly colored and yields will be reduced. Nitrogen deficiency often occurs when a permanent grass is seeded in the orchard or when a large amount of organic matter which is low in nitrogen, such as straw, is worked into the soil. Deficiency symptoms may also occur when fertilizer is leached by heavy rains.

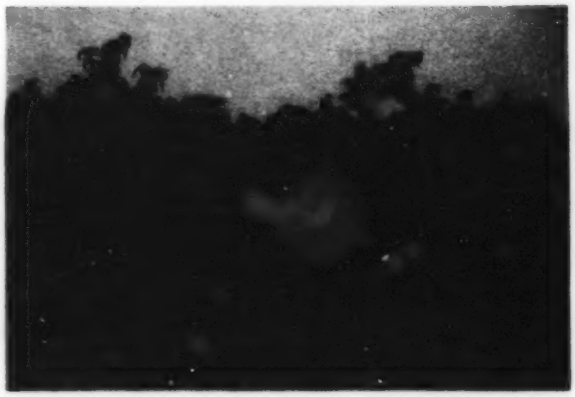

Figure 1. Nitrogen deficiency often occurs when a large amount of organic matter with low N content is incorporated in the soil or when grass is seeded. Leaves are small, light green. Growth and vigour are reduced.

Excessive nitrogen results in symptoms opposite to nitrogen deficiency. Leaves will be large and dark green. Growth is excessive. Leaf fall is delayed and trees or vines may be sensitive to winter injury. Fruit tends to be large, soft, poorly colored and not keep well. Excessive nitrogen may lead to more serious disease problems such as fireblight, peach canker and fruit rot. Nitrogen excess in Ontario orchards is more common than nitrogen deficiency because of excessive rates of nitrogen fertilizer.

Phosphorus deficiency is uncommon with fruit trees or grapes. Under controlled experimental conditions, trees grown without phosphorus have small dark-green leaves with a bronze to purplish tinge. Leaves are sparse and drop prematurely.

Phosphorus deficiency is more common with strawberries. Symptoms may develop in early spring when blossoms begin to appear. This may be related to cool soil conditions. Leaves are stunted and dark-green to purplish. The purple color first appears in the small veins of older leaves, spreads to larger veins, and then to the whole leaf. Leaf petioles may be a bright-red color.

Potassium deficiency shows on the older leaves first, since potassium is translocated to the growing tip from the older leaves. Interveinal purpling starting at the leaf margin and working into the centre of the leaf is typical of potassium deficiency. In cherry, the leaf margin area may stop growing, causing the leaf to cup. Later, leaf margins become brown. Necrotic spots develop between leaf veins and may drop out.

Figure 2. Potassium deficiency shows first on older leaves. It is common in grapes grown in clay loam soil where potassium is unavailable, particularly in dry weather. It is also common with all fruit crops on sandy loam soils where potassium may be leached.

Fruit will ripen unevenly and have poor and/or variable color development. Potassium deficiency is more severe in dry weather.

Excessive potassium leads to magnesium deficiency.

Magnesium deficiency, like potassium deficiency, develops in older leaves of the current season's growth, since magnesium is mobile and is translocated to the growing tip. It shows first as a fading of green and then a yellowing between the veins. Necrotic spots develop later and eventually the leaves drop prematurely. If deficiency is prolonged, only a few pale leaves are left at the growing tip.

Fruit matures early, is highly colored and drops prematurely. Fruit bud formation may be limited. In grapes, fruit sugar content may be low.

Symptoms are most pronounced at the end of the growing season and are more severe in wet years.

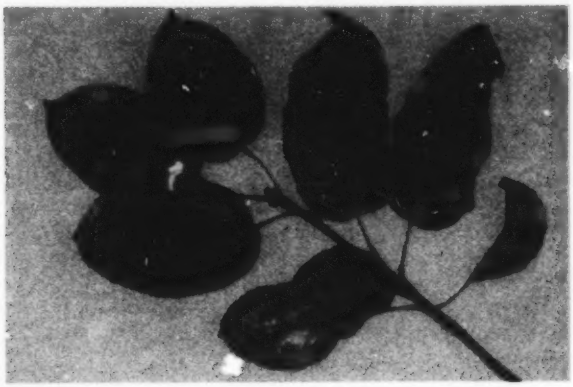

Figure 3. Magnesium deficiency shows first on older leaves as yellowing between veins. Necrotic spots develop and leaves drop prematurely.

Manganese deficiency is more common when the soil pH is high. It shows first at the growing tip on the young developing leaves which become bright yellow between the veins. The veins remain green and the contrast between the dark-green veins and yellow interveinal area is striking. If deficiency is prolonged, the entire leaf assumes a dull-yellow appearance followed by premature leaf drop.

Figure 4. Manganese deficiency develops on younger leaves first. It shows as yellowing between veins. Veins remain green. Soil pH may be high, reducing availability of manganese.

Manganese deficiency may appear early in the season under excessive-moisture conditions and later disappear.

Manganese toxicity occurs when the soil is extremely acid (pH 5.5 or lower). It has been identified on peach and Delicious apple in Ontario. The bark of new shoots becomes necrotic, developing "measles". Growth is stunted. Lime raises the soil pH and corrects this problem. Preferably lime should be applied before planting if a soil test indicates the need.

Iron and manganese deficiency symptoms are very similar. They show first as yellowing of new leaves at the growing tip. Veins remain green longer with manganese deficiency than with iron deficiency, where small veins may become chlorotic. Iron deficiency occurs more frequently when the pH is high and can be caused by high levels of lime (lime-induced chlorosis). Shoots may die back if iron deficiency is not corrected.

Zinc deficiency results in a stunting of terminal growth of shoots. Leaves will be small and appear in whorls or rosettes rather than on extended shoots. Leaves may be chlorotic and narrower than usual. Defoliation may occur early, starting with older leaves.

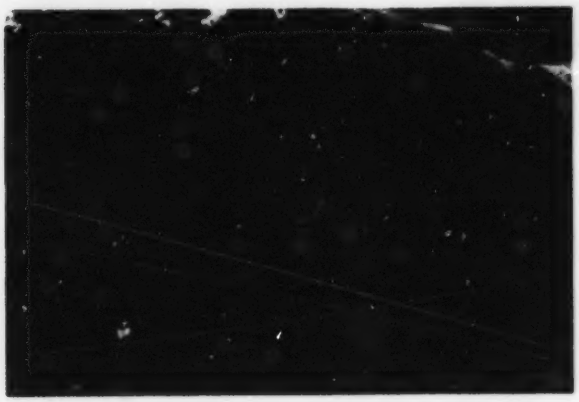

Figure 5. Zinc deficiency shows as a lack of terminal growth. Because of this, leaves appear in whorls or rosettes.

Calcium deficiency does not usually cause foliar symptoms but does show as fruit disorders. Bitter pit of certain apple varieties, breakdown of Spartan apples, gumming of Italian prune and breakdown of stems of bunches (rachis) of certain grape varieties have been related to a lack of calcium. A shortage of calcium in the developing fruit causes these disorders. There may be ample in the soil and leaves but it does not move to the expanding fruit since calcium is immobile in the plant. Spray applications of calcium to the fruit have avoided these problems and also increased apple fruit firmness.

Figure 6. Calcium deficiency causes fruit disorders such as bitter pit in apple fruit.

Boron deficiency also develops as a fruit disorder. Fruit is highly colored and internal breakdown occurs when boron is in short supply. Fruit drops prematurely. Boron deficiency is more common in dry weather and in soils with a high pH. Boron deficiency may result in reduced translocation of calcium to the fruit as it develops.

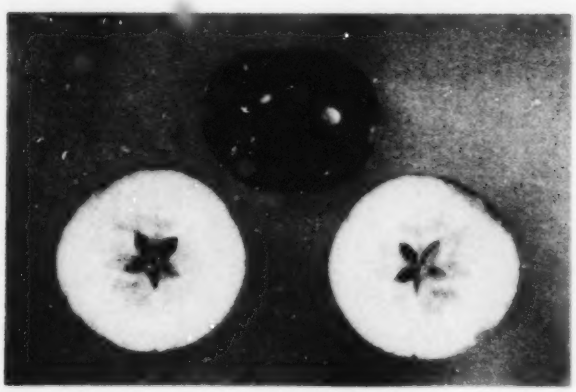

Figure 7. Boron deficiency causes internal breakdown of apple. Fruit drops prematurely and is more highly colored.

Deficiencies of the other essential nutrient elements, **sulphur, copper, molybdenum** and **chloride** have not caused problems in Ontario fruit crops. Soils are normally supplied with sufficient quantities of these nutrients.

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